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SCIENCE

FRIDAY, JUNE 10, 1921

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INAUGURAL ADDRESS[1]

THE institute, like every other educational enterprise, has its individual problems and needs, but these I do not yet sufficiently understand to make a public discussion of them profitable to anybody. What I shall say, therefore, bears on technical education in general without reference to the separate needs of this or any other school.

I

Many of you who have lately become familiar with Mr. H. G. Wells's interpretation of history will realize new significance in the fact that children are born into a world that is already old. For many thousand years before our generation men were experimenting with Nature, with social, economic, political, and religious ideas and practices. Our civilization to-day is the forward-borne product of this slowly and painfully acquired experience of the race.

The whole educational process, broadly seen, is the problem of putting our young people in touch with the more outstanding results of this age-old accumulation and of giving them exercise in the most direct thought processes by which this experience and knowledge have been acquired; processes by which experience and knowledge may be enlarged and extended.

The education of boy or girl, therefore, consists in bringing them up to the present day, so that they can enter independent life as useful thinkers and doers in the world as it is. Dreams of what the world ought to be are not only stimulating but indispensable to human progress, but each generation must begin building on the world as it finds it.

Expressed otherwise, our educational effort

[1] Given by Dr. Ernest Fox Nichols on the occasion of his installation as president of the Massachusetts Institute of Technology.

is directed to give a young man of intellectual interests and possibilities the main features of his racial background and especially to acquaint him with the best and most significant things which have been thought and done in the world, so that at maturity all new things which present themselves to him, he can in some measure appraise in their relations to this background.

I know no better measure of a man's real education than the adequacy of his thought and action in whatever actual situations he may find himself, for adequacy of thought and action imply some hold on world experience. Our daily use of the phrase "common sense" has no other meaning.

Vital possession, conscious or unconscious, of this world background enables a man sanely to face and interpret reality. You rarely find such a man seriously occupied in chasing rainbows or fighting windmills. His chief mental characteristics ars breadth, balance, sanity. To train such men and women should be the dominant ideal of the educational process. How often and how far, alas! do we fall short of attaining it.

Mr. Chesterton's recent amusing raillery at "The ignorance of the educated" would lose none of its charming humor and would gain in truth and pungency if he changed his title to "The ignorance of the half educated." These are the really dangerous men, for they are facile of speech and wholly unaware of their intellectual limitations. By contrast the adequately educated man knows always just where he stands. Ought not an engineer to know enough of philosophy and its uses not to be misled into dogmatizing upon its technical intricacies: and should not a philosopher be taught enough about bridges and dynamos to be satisfied with dwelling on the broad scientific principles they illustrate without venturing to criticize minor details of construction?

Education interpreted as a background builder is far wider than the schools and stretches endlessly from the cradle to the grave. Yet a careful scrutiny of the course of individual development shows that in the latter half of the period of adolescence, say from eighteen to twenty-five years of age, lie the strategic years of education. It is in this period that wisely directed teaching can do most to integrate and interpret this background, do most to give it unity of form and grouping, color, symmetry, and depth. During this formative period no great department of human experience can be safely ignored, if our purpose is to train adequately educated men and women.

The department of human experience and action on which the major emphasis shall fall is a matter wisely left to the individual preference, aptitude, and taste of the student. In schools of technology this emphasis falls naturally on the study of science. But studies in science can be made as narrow as can studies in philosophy and the arts. Narrowness of outlook, always a major defect in our efforts at education, we must strive unceasingly to avoid. All fields of knowledge and experience form a whole, and, in our teaching, their vital interdependence must be most clearly emphasized.

With his characteristic grasp of essentials, President Nicholas Murray Butler has stated these traits of the educated man: (1) Correctness and precision in the use of English; (2) refined and gentle manners; (3) power of reflection; (4) power of growth; (5) sound standards of feeling and appreciation; (6) the ability to do efficiently without nervous agitation. To these I venture to add yet another trait of the *usefully* educated man: Power to marshal the world's experience in at least one field, and to use it effectively for further constructive achievement.

Engineers have, surely, the same broad, educational rights and responsibilities as other professional and non-professional men, yet, amid the growing complexities and perplexities of technical education there has been, and is, a steady and strong temptation to introduce more detailed technical courses at the expense of other background building studies. This temptation, weighty as are the arguments for yielding to it, must nevertheless be steadily and firmly resisted. The problem of modern technical education is indeed most intricate and difficult, but other solutions must be

earnestly sought, for we can not afford to sacrifice the breadth of a man to create a too narrowly efficient machine.

II

When President Maclaurin said "A technical school was not doing its whole duty unless it kept in the closest touch with industry," he spoke the minds of many thoughtful men.

The two outstanding industrial problems to-day are: (1) The more intensive application of scientific knowledge and research to the processes and products of industry; (2) the cultivation of more understanding and wholesome relations between labor and management. Both of these problems may rightly claim attention in any modern scheme of technical education. On each of these questions I wish to speak very briefly.

Of scientific research there are two more or less distinct types. Both embody the genuine spirit of inquiry; both use the same tools and instruments under similar laboratory conditions. The essential difference between them is not in method but in aim and intention. In applied science research, the controlling purpose is to reach a definite and predetermined result which can be immediately applied to the material profit, convenience, or comfort of man. In pure science research, the only purpose is the discovery of new knowledge without thought of any material benefit to anybody. The fundamental discoveries from which applied science gets its raw material for useful applications come out of the pure science laboratory. That you can not apply knowledge you haven't got needs no proving.

Take any familiar application of science you choose, and one, two, or at most three backward steps bring you to the pure science laboratory where the fact or principle employed was first discovered. Sir J. J. Thomson has said in substance, "If you want improvements in industry, you may turn with confidence to applied science. If you want to revolutionize an industry or create a new one, you will do well to search the innermost recesses of the pure science laboratory." The difference between the man of theory and the practical man is one of suggestiveness and scope.

Applied science research in the modern sense is of comparatively recent origin. What we now call pure science is centuries older. At its beginning, therefore, applied science had the accumulated results of centuries of pure science to draw upon, but, due to the brilliantly amazing progress of applied science, that surplus in many fields is nearing exhaustion.

With depleted reserves applied science must soon face one of two alternatives. Either it must descend from its past and present rapid succession of great achievements to a more modest hand-to-mouth existence, reworking old ones and consuming next year whatever pure science, at its present working rate, may discover this; or else the hosts of pure science research must be vastly strengthened, and the volume of their yearly output many times increased.

That some of our more progressive industries already realize the situation is amply proved by the very rapidly increasing amount of pure science research issuing from the research laboratories of our optical, chemical, electrical, and other highly developed industries.

Under these circumstances technical schools owe to modern industry the more intensive cultivation of research with increasing emphasis on pure science. Every possible means should be used to train up more men in pure science, men competent to enter the fruitful and important field of research, to supply the rapidly increasing demand for workers in the fast multiplying laboratories of progressive industry.

In every fruitful cooperation between technical education and industry, our schools should be prepared to give more than they receive and to lead, not follow.

III

Under the present organization of our largest industries the conscious responsibilities of real ownership have become somewhat vague. Industrial ownership to-day is widely diffused

and dispersed. Shares of ownership are bought and sold daily by hundreds of thousands. Certificates of ownership are often regarded by their holders more as sources of income than as symbols of responsibility.

As a working plan the rights and duties of ownership are delegated to boards of directors, and the active management of our industries rests in the hands of employees. Thus the older distinction of employer, meaning owner, and employee, meaning workman, has largely ceased in our largest industrial corporations. All are essentially employees but of two distinct classes, brain workers and hand workers. The brain workers build up, maintain, and manage the business, and direct the hand workers, as brain directs hands in the individual, with this important and sometimes vaguely realized difference, that the hands in this case are not instruments only but independent thinking, feeling personalities.

The older or traditional attitude toward labor unrest was that the questions involved were purely economic questions. More thoughtful and more widely informed people, and there are many of them, feel that the problem is not so simple, but involves many additional elements, chiefly those which enter into all human relationships.

Purely for the sake of illustration, let us take the case of a not uncommon type of workman who becomes dissatisfied with his job. He feels little or no loyalty to the business nor to the foreman or manager who personifies it. He understands neither the manager's work in relation to production, nor the manager's pay.

There are further enviable differences between the manager's apparent freedom of action, his more comfortable working surroundings and those of the laborer. The laborer fails to realize the economic reasons for these differences. The manager in his sight produces nothing, hence the laborer doubts in his heart the importance of managers and higher officials in general. From his warped outlook, wages would be higher if these men who meddle, but do no real work, were removed from the payroll.

Thus he feels little respect or liking for the management. The manager may also seem lacking in respect for a sour-tempered operative. The motives behind the simplest manifestations of good will may be misconstrued and distrusted. Thus a mutual economic necessity is the only binding material which holds these two together, and each chafes at the bond.

Dissatisfied, the laborer shirks and hates his employment which, in this mood, is without human appeal or interest for him. Furtively shirking, he loses some of his sense of personal dignity and much of his self-respect. Sooner or later, as circumstances favor, he will try to regain a feeling of self-importance by trying with others who are like-minded a concerted conflict with the management in the form of a strike.

If the strike is won, the worker feels his course justified, his conduct approved, his self-esteem in a measure restored. If lost, he returns to his work liking it and his superiors none the better, only to wait sullenly for another trial of strength.

The laborer's indiscriminate and integrated discontent he is likely to attribute to the specter called capitalism. Capitalism is, therefore, his enemy. This monster he attacks in the one spot where he believes its nervous system is centered—its purse. To the agitator of disorganization this mass of accumulated and unsorted discontent is his one great opportunity, and we know he is quick to make the most of it. To the typical proletarian, not the least of the attractions of a world-leveling-down program is the removal of the people he believes respect neither him nor his labor.

This brief view of the tangle of disorders and misconceptions, which may arise in a workingman's mind, shows mental states of by no means infrequent occurrence.

Now the true essence of successful industry is mutual respect between employee and manager, willing cooperation, a sense of mutual opportunity and responsibility, and a shared personal or institutional loyalty. But these factors are human rather than economic. Economic necessity alone is not only powerless to

create them but oftener operates to weaken or destroy them.

Human relationships in industry we have now and always have had, and, whether recognized or not, they have caused quite as much trouble as purely economic conditions, for the state of a laborer's mind, more even than the state of his purse, determines his acts.

No industrial question is of greater importance than human relations in industry, and none is more complex nor baffling. Yet no pains can be spared, or are being spared, to find remedial measures. Many hopeful schemes for a better human organization of industry have been suggested and are under trial, some fortunately with encouraging promise.

The dominant bearing of this discussion on technical education is this: Our technical schools are training the future brain workers and managers of industry. We may, therefore, well ask ourselves, at this time, if there is anything we can do beyond what we are now doing to train our students to understand more fundamentally and to meet more successfully the gravest of all their future repsonsibilities, the organization and management of men. A responsibility which they and we owe, not industry alone, but the whole economic, social, and political stability of the nation.

ERNEST FOX NICHOLS

SCIENCE AND COMMUNITY TRUSTS

THE Research Information Service of the National Research Council recently compiled available information about funds for scientific research. It appears that there are hundreds of special funds, trusts or foundations for the encouragement or support of research in the mathematical, physical, and biological sciences, and their applications in engineering, medicine, agriculture and other useful arts. The chief uses of these moneys are prizes, medals, research scholarships or fellowships, grants, sustaining appropriations, and endowments.

So numerous have been the requests to the Research Council for information about sources of research funds, availability of support for specific projects, and mode of administration of particular trusts or foundations that the Research Information Service has created a special file for this information which it is proposed to keep up to date for the benefit of those who may desire to use it. Furthermore, in order to give wider publicity to the immediately available information, the Council has issued a bulletin under the title, "Funds available in 1920 in the United States of America for the encouragement of scientific research." This publication has been distributed widely to American scientists and to those who are interested in furthering the development of science.[1]

In the course of search for data on research funds, it was discovered that some of the recently created community foundations or trusts control funds which may be used, at the discretion of their distributing boards, for scientific surveys or for research. If the resources of community foundations be added to the funds at present listed by the Research Information Service as primarily for research in the natural sciences, the total approximates five hundred million dollars. It is estimated that for the encouragement and support of scientific research through medals, prizes, grants and research scholarships and fellowships, between forty and fifty million dollars is spent in the United States annually.

The "community trust" idea is of peculiar interest and significance in this connection. In the year 1914 certain wise and far-sighted citizens of Cleveland decided to organize for the benefit of the community a trust to be known as the Cleveland Foundation. This, the original community trust, has grown to a fund of approximately one hundred million dollars, either given or bequeathed. Following the lead of Cleveland, more than forty other American cities have organized similar trusts, primarily to assure greater security of principal, flexibility in the use of income, and prevention of obsolescence.

[1] Inquiries concerning research funds should be addressed to the National Research Council, Information Service, 1701 Massachusetts Avenue, Washington, D. C.

The seriousness of the risk of obsolescence and the enormous economic waste which results therefrom are effectively presented by Mr. Frank J. Parsons, Director of the New York Community Trust:

Judge F. H. Goff, originator of the community trust plan, is authority for the statement that in England alone there are some 40,000 foundations or trusts with fixed objects. The great majority of these bequests have become obsolescent by reason of social or economic changes. The situation finally became so serious in England that Parliament passed an Act, the intent of which was to revive the trusts and renew their usefulness.

The United States, although young, is by no means free from illustrations of the folly of making charitable gifts with fixed objects. Benjamin Franklin, one of the wisest of Americans, set aside a certain sum of money in his will, to be used only for the maintenance and benefit of a certain type of artisan, numerous at the time, but non-existent to-day because of changes in social conditions and the introduction of machinery. Wise in his own generation, Franklin failed when he tried to provide for the indefinite future.

Prior to 1850 Bryan Mullanphy, a wealthy lawyer and at one time mayor of St. Louis, personally helped hundreds of travelers who became stranded in his city on their way to the great undeveloped West. When he died it was found that he had left one third of all his property to the City of St. Louis, as trustee, to "aid and assist worthy and distressed travelers and emigrants coming to the City of St. Louis *bona fide* to settle for a home in the West." His act was greatly commended and all thought he had wisely applied his charity to meet a great need; yet fifteen years later the railroads had pushed into the West far beyond St. Louis, and the number of needy travelers coming within the terms of the bounty of Mullanphy's will was greatly diminished and is now practically nil. The estate now amounts to $975,000, and the three Commissioners having the management of the city's trust are still bound by the original terms of the will as laid down in 1851.

In 1907 Robert N. Carson, of Philadelphia, left $3,500,000 for the care and education of "poor white healthy girls, both of whose parents shall be deceased," and in 1909 Charles E. Ellis, also of Philadelphia, left $4,500,000 for "full orphan or fatherless girls." The hampering and restrictive conditions of the wills in each case were such, however, that after the lapse of more than ten years the trustees of these two great gifts are caring for but 114 girls, while the funds are said to be sufficient to provide for from 600 to 1,000 girls.[2]

The following "illustrative purposes" are quoted from the Resolution and Declaration of Trust creating the New York Community Trust:

(*a*) For assisting public educational, charitable or benevolent institutions, whether supported wholly or in part by private donations or by public taxation;

(*b*) For promoting scientific research for the advancement of human knowledge and the alleviation of human suffering or the suffering of animals;

(*c*) For the care of the sick, aged and helpless;

(*d*) For the care of needy men, women and children;

(*e*) For aiding in the reformation of (1) victims of narcotics, drugs and intoxicating liquors, (2) released inmates of penal and reformatory institutions, and (3) wayward or delinquent persons;

(*f*) For the improvement of living and working conditions;

(*g*) For providing facilities for public recreation;

(*h*) For the encouragement of social and domestic hygiene;

(*i*) For the encouragement of sanitation and measures for the prevention of disease;

(*j*) For investigating or promoting the investigation of or research into the causes of ignorance, poverty and vice, preventing the operation of such causes, and remedying or ameliorating the conditions resulting therefrom.

Science as well as charity has its "dead hand" trusts. It is wholly impossible for anyone to predict future conditions or needs. Consequently the community trust idea should interest all who desire to promote the public welfare with minimum risk of having their gifts pass into desuetude. Many of the existing foundations and corporations which bear the names of individuals are in principle

[2] These statements are in part quoted from Mr. Parsons and in part paraphrased for the sake of brevity.

community trusts, but they have the temporary disadvantage of intimate association with the personality or memory of a particular family or individual. They therefore are somewhat less likely to receive during their early history such gifts as readily come to the community trust which bears the name of a city or state.

ROBERT M. YERKES
NATIONAL RESEARCH COUNCIL

SCIENTIFIC EVENTS

THE MEDICAL SCHOOL OF COLUMBIA UNIVERSITY AND THE PRESBYTERIAN HOSPITAL

IT has been announced from Columbia University that a permanent alliance has been effected between the university and the Presbyterian Hospital, to provide a medical center, and the large sums needed to carry the plan into effect, have been provided by gift.

Under the terms of the agreement, the university and the hospital each continue their independent existence and control. The medical school, now occupying the site bounded by 59th and 60th Streets and Tenth Avenue, and the hospital, now occupying the site between Madison and Park Avenues, 69th and 70th Streets, are as soon as possible to be provided with new and thoroughly equipped buildings upon a common site. The professional staff of the hospital is to consist of professors and other members of the faculty of the medical school, to be appointed by the hospital upon the nomination of the university. For the oversight of the common interests of the university and the hospital in the new undertaking, an administrative board is established, to consist of three representatives of the trustees of the university and three representatives of the managers of the hospital. The first administrative board is to consist of Messrs. John G. Milburn, Walter B. James, and William Barclay Parsons, representing the university, and Edward S. Harkness, Henry W. deForest and William Sloane, representing the hospital.

The large sums needed to enable Columbia University to bear its share in this enterprise, have been provided in the following manner:

$5,000,000 for endowment from the estate of the late Joseph R. DeLamar.

$3,000,000 for the construction of new buildings and their equipment, from the Carnegie Corporation, the General Education Board and the Rockefeller Foundation, each of which has pledged $1,000,000.

Land located between 165th and 168th Streets, Broadway and Fort Washington Avenue and valued at not less than $1,000,000, which is the gift of a donor who wishes to remain anonymous.

An additional sum of $1,000,000 for endowment from another anonymous donor.

GIFTS BY CARNEGIE CORPORATION TO CARNEGIE INSTITUTES OF PITTSBURGH

As a result of joint conferences held by the trustees, respectively, of the Carnegie Corporation of New York, the Carnegie Institute of Pittsburgh and the Carnegie Institute of Technology, a definite agreement has been entered into by the Carnegie Corporation to give an additional sum of more than $17,000,000 over a period of years for maintenance and development of the institutes.

According to a statement issued by the Carnegie Corporation, the Carnegie Institute of Technology now has about 4,000 students. They come from every state in the Union and from all parts of the world. The plan now to be carried out contemplates the full completion of Mr. Carnegie's gift in developing at Pittsburgh a great technical institute available for the young men, and particularly those in moderate circumstances, not only of the Pittsburgh district, but of the whole country. The plan is distinctly national in scope.

Under the arrangements now made, the institutions ultimately will have received from Mr. Carnegie, the corporation and other sources more than $49,000,000. The financial program that has just been mapped out may be summarized as follows:

OUTRIGHT APPROPRIATIONS

For the Carnegie Institute of Pittsburgh:	
Additional endowment	$2,000,000
Cash to be used at discretion of institute	672,888

For the Carnegie Institute of Technology:	
For expenses over a period of 25 years	5,640,000
For repairs and replacement of equipment	350,000
For a gymnasium, the planning of which is to begin at once	600,000
Total	$9,262,888

CONDITIONAL UPON ADDITIONAL SUMS BEING RAISED

For the Carnegie Institute of Pittsburgh:	
To accrue in 15 years on condition that an equal amount is raised for endowment of educational work of the Museum and Art Gallery	$ 200,000
For the Carnegie Institute of Technology:	
Maximum to be paid by July 1, 1946, on a basis of $2 for every $1 raised from other sources	8,000,000
Total	$8,200,000

SUMS TO BE RAISED FROM OUTSIDE SOURCES

For the Carnegie Institute of Pittsburgh:	$ 200,000
For the Carnegie Institute of Technology	4,000,000
Total	$4,200,000

From Mr. Carnegie during his lifetime and later from the Carnegie Corporation, the two Carnegie Institutes in Pittsburgh have already received $27,654,594.51, and the present program supplements those funds. Consummation of the financial arrangements now entered into will result as follows:

Previous appropriations made by Mr. Carnegie and the Carnegie Corporation	$27,654,594.51
Present outright appropriations	9,262,888.00
Present appropriations, conditional upon raising funds from other sources	8,200,000.00
Sums to be raised from other sources	4,200,000.00
Grand total	$49,317,482.51

MEETINGS OF BRTISH AND AMERICAN CHEMISTS

Joint meetings will be held this autumn by chemists of Great Britain, Canada and the United States. Members of the Society of Chemical Industry of Great Britain will join with the Canadian branch of their organization in sessions in Montreal late in August. The scientific and business sessions will center at McGill University, where there will be a special convocation. The Canadian and British chemists will inspect numerous plants and will proceed to Ottawa and Toronto, where they will be entertained by the local sections. On September 5 they will reach Niagara Falls, where they will view the vast establishments which modern physics and chemistry have created.

The members will then cross the border, being met by a committee of the American section of their society and conducted through the industrial plants on this side of the Falls. Dinner will be served at Buffalo, and on their arrival at Syracuse, they will have luncheon with the Solvay Process Company. The chemists will then go to Albany and New York City, where they will be welcomed by the American Section of the Society of Chemical Industry.

Elaborate arrangements for the reception of the chemists will be carried out, through the coordinating committee, of which Dr. B. C. Hesse is chairman and Dr. Allen Rogers is secretary. The festivities, meetings and entertainments which will follow are designed to bring into closer bonds all chemists of Anglo-Saxon stock.

The fall meeting of the American Chemical Society, with its 15,500 members, is to be held in New York City from September 6 to 10, inclusive. The first contact will be at a lawn party, to be given on the afternoon of September 7 to foreign guests and to scientific societies at Columbia University. Other societies asked to participate in the welcoming of the visitors from abroad are: The American Electrochemical Society; the American Institute of Chemical Engineers; the American Section of the Société de Chimie industrielle;

and the Manufacturing Chemists' Association of the United States. The foreign guests have also been invited to the smoker and entertainment of the American Chemical Society, which will be held on the evening of Wednesday, September 7.

Scientific sessions of the American Chemical Society, in which many matters concerning chemical research and applied chemistry will be discussed, are to be held at Columbia University. To these meetings the British and Canadian guests have been bidden. They will also be present at the banquet of the American Chemical Society on the evening of September 9 at the Waldorf-Astoria.

The fortnight beginning September 12 will be dedicated to American chemistry in all its phases, for it marks the holding of the National Exposition of Chemical Industries, which is to be held in the Coast Artillery Armory in the Bronx. There will be brought together under one roof a demonstration of what has been accomplished in this country since the European War in adapting the resources of the United States to national needs.

ORGANIZATION OF MEMBERS OF THE AMERICAN ASSOCIATION AT THE PENNSYLVANIA STATE COLLEGE

AT the Pennsylvania State College, State College, Pa., the members of the American Association for the Advancement of Science, numbering about forty, met for dinner at the University Club on May 20. Professor A. J. Wood, of the school of engineering, presided. The speaker of the evening, Dr. Ira N. Hollis, president of the Worcester Polytechnic Institute, outlined the types of research suitable for educational institutions as differentiated from the purely applied types of investigations more appropriately undertaken by commercial firms. Dr. Hollis regretted that so much of the scientific effort of this age has had to go into methods of destruction of all that civilization has built up, and spoke in the highest terms of the utility of such researches as that of Professor Michelson in perfecting methods of accurate astronomical measurements which aid humanity in a comprehension of the immensity of the universe.

A discussion of the status and the prospects for scientific research at the institution was led by the deans of the various schools and the president of the college. A committee will plan for further meetings next year.

SCIENTIFIC NOTES AND NEWS

COLUMBIA UNIVERSITY at its commencement exercises conferred the degree of doctor of science on Mme. Curie, Dr. John C. Merriam, president of the Carnegie Institution of Washington, and Dr. Samuel W. Lambert, dean emeritus of the school of medicine. The degree of doctor of laws was conferred on Dr. James Rowland Angell, president elect of Yale University. The candidates were presented by Dr. James F. Kemp, professor of geology.

THE Case School of Applied Science has conferred the doctorate of science on Albert Sauveur, professor of metallurgy and metallography in Harvard University.

PROFESSOR JOHN M. COULTER, of the University of Chicago, and Dr. Samuel Garman, of the Harvard Museum of Comparative Zoology, have been elected foreign members of the Linnean Society of London.

THE Franklin Institute has conferred its Franklin medal and certificate of honorary membership on Professor Charles Fabry, of the University of Paris, for his studies in the field of light radiation.

PROFESSOR ALBERT EINSTEIN sailed for Liverpool on the *Celtic* on May 30. He will deliver the Adamson lecture of the University of Manchester. He will afterwards lecture at King's College, London, and other institutions.

MME. CURIE was given on May 26 the degree of doctor of laws by the University of Pittsburgh, being presented by Dr. W. J. Holland. During the day she visited the laboratories where was refined the gram of radium presented to her by President Harding on behalf of American women. On the following day she went to Canonsburg, Pa., to inspect the plant where the ore from which radium is obtained passes through the initial processes of

reduction. Previously Mme. Curie had spent two hours at the plant of the Welsbach Company, Gloucester, N. J., and the company presented her with 50 milligrams of mesothorium. Mme. Curie, accompanied by her daughters, is now visiting the Grand Canyon and the Yellowstone Park.

The Rockefeller Foundation gave a dinner in honor of Dr. Carlos Chagas, head of the department of health in the Republic of Brazil, at the Waldorf-Astoria, on May 20. Dr. George E. Vincent presided as toastmaster, and addresses of welcome were made by John D. Rockefeller, Jr., Dr. Hermann M. Biggs, Dr. Paulo de Proenca and the Brazilian ambassador to the United States. Dr. Chagas, director of the Institute Oswaldo Cruz, Rio de Janeiro, gave a series of three lectures on "American trypanosomiasis" at the Harvard Medical School, May 26 and 27.

We learn from *Nature* that the presentation of the first award of the Kelvin medal was made by the Right Hon. A. J. Balfour in the hall of the Institution of Civil Engineers to Dr. W. C. Unwin on May 4. The medal was founded in 1914, principally by British and American engineers, to commemorate the achievements of Lord Kelvin in those branches of science which are especially applicable to engineering.

A commission of five engineers has been appointed to visit England in June to present the John Fritz medal to Sir John Hadfield, in recognition of his scientific research work. The members of the commission are as follows: Dr. Ira N. Hollis, president of Worcester Polytechnic Institute; Charles T. Main, of Boston, representing the American Society of Civil Engineers; Col. Arthur S. Dwight, of New York, representing the American Institute of Mining and Metallurgical Engineers; Ambrose Swasey, of Cleveland, of the John Fritz medal award board and the American Society of Mechanical Engineers, and Dr. F. B. Jewett, of New York, of the American Institute of Electrical Engineers.

President Harding, on June 3, designated Major Lawrence Martin as the representative of the Department of State on the United States Geographic Board.

Mr. Frank C. Baker, curator of the Museum of Natural History, University of Illinois, will spend the summer in Wisconsin, continuing his study of the molluscan fauna under the auspices of the Wisconsin Geological and Natural History Survey.

Arthur D. Little, Inc., announce that Chester M. Clark, formerly head of the corporation department of Stone & Webster, has been elected treasurer. Merton R. Sumner has been appointed chief engineer. Mr. Sumner was formerly chief engineer for New England of Fred T. Ley & Company, and more recently of the Fuller Industrial Engineering Corporation.

The centenary of Bloomingdale Hospital at White Plains, N. Y., for the treatment of nervous and mental disorders, was celebrated on May 26. A special program of addresses had been arranged by Dr. William L. Russell, medical superintendent, for the morning session, and in the afternoon there were tableaux showing the origin of the asylum, its growth and the development of science in the treatment of the insane. Addresses were made by Dr. Pierre Janet, professor in the College of France, Paris; Dr. Richard G. Rowe, director of the Neuro-psychiatric Hospital, London; Dr. Llewellys F. Barker, of the Johns Hopkins Medical School, and Dr. Adolf Meyer, professor of psychiatry in the Johns Hopkins Medical School.

Professor William Crocker, in charge of the plant physiology department of the University of Chicago and director of the Thompson Institute for Plant Research at Yonkers, New York, gave an address on "The physiology of seed germination" before the biology club of the University of Minnesota at University Farm on May 16. The following afternoon Professor Crocker spoke on an "Effective attack on plant physiological problems" before the experiment station staff and other faculty men.

A lecture entitled "The study of organic reactions occurring in living matter" was de-

livered by Dr. Treat B. Johnson, professor of organic chemistry at Yale University, before the Philadelphia section of the American Chemical Society on the evening of May 14.

DR. JOHN C. MERRIAM, president of the Carnegie Institution of Washington, delivered a lecture at the State University of Iowa in April, entitled "Recent researches on the antiquity of man in California." He also addressed the Geology Club on "The Fauna of Rancho La Brea."

THE committee organized in 1911 by the late Professor MacGregor to promote a memorial to Professor Tait in the form of a second chair of natural philosophy at Edinburgh, reports that the Tait chair will shortly be established.

CHARLES PICKERING BOWDITCH, known for his research in the field of archeology, died on June 1, in his seventy-ninth year.

THE death is announced of Abbott Thayer, the distinguished artist, known also for his studies of protective coloration.

DR. E. J. MILLS, F.R.S., emeritus professor of technical chemistry in the Royal Technical College, Glasgow, died on April 21, at seventy-nine years of age.

THE American Society of Mechanical Engineers extended an invitation to members of the American Association for the Advancement of Science, to attend the May meeting of the Society at Chicago. The program of this meeting gave special emphasis to the problems of Chicago as a mid-western rail-water gateway. Two excursions were planned: one to McCook Field, for those interested in aeronautics, and the other to the Rock Island Arsenal.

THE Engineering Foundation assumes responsibility for sending the following note to the daily press: "Dr. Charles Benson Davis, of New York City, claims in a paper which he has prepared and submitted to Engineering Foundation, that he can make and has made some of the chemical elements, such as gold, silver, platinum and copper, by transmutation of a common element. He has shown samples of the metals he claims to have made to members of the Engineering Foundation in New York City, and has requested that body to investigate his claims and his methods. Dr. Davis is a reputable chemist, a member of the Society of Chemical Industry, a Fellow of the British Chemical Society, and an Honorary Member of the Société Académique d' Histoire Internationale. He is the author of several papers which have been published in chemical journals."

DR. EDWARD A. SPITZKA, formerly professor of anatomy at Jefferson Medical College, Philadelphia, has donated to the U. S. National Museum his collection of brains of distinguished persons.

WE learn from the *Journal* of the American Medical Association that at the annual meeting of the New York Association for Medical Education held at the Academy of Medicine on March 7, the by-laws were amended and the board of directors was reconstituted to apportion the control of the association's affairs to the five medical schools of greater New York; namely, Columbia University, College of Physicians and Surgeons; Cornell University Medical College; the Long Island College Hospital; the New York Post-Graduate Medical School and Hospital, and the University and Bellevue Hospital Medical College. This means that for the first time in the history of New York City the five medical schools will cooperate to develop New York City as a medical teaching center. The mayor, the commissioner of health, and the commissioner of public welfare are ex-officio members of the board of directors. Unnecessary duplication of courses of instruction by the several medical schools will be done away with. New courses and a higher type of graduate work will be instituted. The new officers of the association are: president, Dr. Haven Emerson, formerly health commissioner of New York City, and at present in charge of the War Risk Bureau; secretary, Dr. Otto V. Huffman, at present associate professor of medicine at the New York Post-Graduate Medical School and Hospital, formerly secretary of the state board of medical examiners, and secretary-treasurer of the Federation of

State Medical Boards of the United States, and formerly dean of the Long Island College Hospital; treasurer, Dr. George W. Kosmak, attending surgeon of the Lying-In Hospital, and formerly secretary of the American Association of Obstetricians.

UNIVERSITY AND EDUCATIONAL NEWS

A dormitory for foreign students at Columbia University and other schools in New York has been made possible through a gift promised to members of the Cosmopolitan Club, an organization of students in Columbia and New York University. Plans for the dormitory provide for a building of 500 rooms to be erected at a cost approximating $1,000,000, on Riverside Drive opposite Grant's tomb. The newspapers report that the donor is John D. Rockefeller, Jr.

Dr. F. S. Harris, director and agronomist of the Utah Agricultural Experiment Station and professor of agronomy at the Utah Agricultural College, has resigned to become president of the Brigham Young University, at Provo, Utah, where he succeeds Dr. George H. Brimhall, who has been made president emeritus. Professor Wm. Peterson, station geologist and professor of geology in the college, has been appointed to succeed Dr. Harris as director of the station.

Dr. Nathan Fasten, who went to the Oregon Agricultural College last September from the University of Washington, has been promoted to the headship of the department of zoology.

Dr. John W. M. Bunker, who has been for several years at the head of the bacteriological department of the Digestive Ferments Company of Detroit, has been elected assistant professor of biochemistry and physiology at the Massachusetts Institute of Technology.

DISCUSSION AND CORRESPONDENCE

CONCERNING RECENT AURORAS, MAY 13 AND MAY 14, 1921

To the Editor of Science: On the evening of May 13, 1921, there occurred a great aurora, not visible here on account of clouds, but again on the evening of May 14 there was another great display visible here in spite of the half moon and a low-lying fog which tended to spoil the visibility. As in other great auroras, the great bundles of streamers appeared to converge toward the zenith from the south as well as from the north, east and west. The sky at times was virtually covered with auroral light. The outburst of May 13 caused great disturbance to telegraph and telephone wire transmission and must have been of unusual magnitude. All the effects noted in the aurora of May 14 a day later conformed to the perspective ideas, pointed out in my paper, "Inferences concerning auroras," read at the Boston meeting of the National Academy of Sciences on November 14, 1916, and published in its *Proceedings*, Vol. 3, pp. 1–7, January, 1917.

It is rarely that one great aurora follows so closely on the heels of another and at an interval so short as a day. In fact I have no record or recollection of such a happening in my time of observation, which now extends over fifty years, more or less. Hence the conditions lead to the inquiry whether any unusual condition existed in this instance.

An examination of the solar surface appears to provide, or at least suggest, a possible explanation, and at the same time throw light on the nature of the relation of the aurora to the solar disturbances.

On May 15 there were to be seen on the solar surface two large spot areas, separated by an interval of about one-fourteenth of the diameter of the sun, the one following the other as the sun revolved. These two spot areas, quite distinct from each other, were nearly round, the first a single spot, the second a compact group with a much disturbed area adjacent. They were located near the center of the solar disc.

As the solar revolution takes place in nearly 26 days, the interval between the spots appears to be approximately one day of the surface movement.

This means that in about one day the sec-

ond spot would replace the first in relation to the earth. If the first spot gave rise to emission of ions, radially, which in its orbital motion the earth reached and in which it became enveloped, the aurora of May 13 was possibly the result. The same relation repeated a day later by the second spot replacing the first would account for the aurora of May 14.

The relation of the two auroras in time, and the sequence of spot positions on the revolving sun are significant to say the least.

In this connection it may be noted that the great aurora of March 22, 1920, had a very long and unusual duration, beginning early in the evening of that day and continuing all night, even being observed just before sunrise on the 23d. It may have continued during part of that day, invisibly of course. At that time an examination of the solar surface disclosed a remarkably elongated spot area or chain of spots, and at each end of the chain or elongated group was a well-marked rounded spot. The group was fairly uniform in width extending in a direction nearly parallel to the solar equator, and its length would amply account for the long continuance of the aurora if emanations were pouring out from the whole group as it revolved with the the sun. Moreover, its advance past the meridian of the sun was apparently much the same before the aurora as with the two spots believed to have caused the auroras of this year on May 13 and 14. Such an advance points to a period (several hours possibly) required for the ionic emanations from the spot area to traverse the radius of the earth's orbit, from the sun.

Another matter of interest may be mentioned. In many auroras, especially during the greater outbursts, there occurs at times the peculiar streaming upward, as if a luminous wave was running up toward the zenith crown; a sort of flaming effect. The motion is fairly rapid, perhaps one half second being required to traverse the length of the streamer. The point I wish to make is that the apparent velocity of this wave-like luminosity upward seems to be constant in all auroras that I have witnessed and in which it was possible to make an estimation. This should be confirmed or denied by measurement, for those streamers which bear the same relation to the observer, as variations in distance away may affect the result.

ELIHU THOMSON

SWAMPSCOTT, MASS.,
May 16, 1921

THE LANDSLIDE NEAR MONT BLANC

THE March *Bulletin* of the Royal Italian Geographical Society contains an account, well illustrated with map and photographs, by Professor U. Valbusa of the landslides near Mt. Blanc which occurred on the 14th and 19th of November last and made much stir in the newspapers, even to the point of exciting fear that the round-topped "monarch of mountains" had lost some of its height (4,807 meters). Such was by no means the case, as the head of the slide was on the eastern side of the subordinate dome known as Mt. Blanc de Courmayeur (4,709 m.), two kilometers east of and nearly 500 meters lower than the main mountain dome. Granite rock masses about half a square kilometer in total slanting area, were dislodged from the oversteepened side of an east-facing spur, the top of the gray slide-scar being a little lower than the terminal point of the spur which has an altitude of 4,381 meters. The detached rock masses first slid down into a second-order cirque of small size between the spur of origin and the Aiguille blanche de Pétéret, near by on the southeast; there they turned a short distance northeastward and descended from the hanging outlet of the small cirque to a level of about 3,200 meters on the Brenva glacier at the western side of the great first-order cirque in which this glacier gathers its névé branches, and from which a narrower glacial tongue cascades southeastward into the over-deepened trough—locally known as the Allée blanche—of the uppermost Dora Baltea. On reaching the main glacier beneath the small cirque, the slide turned to the right, and gathering ice as it rushed along spread over the whole 3-kilometer breadth of

the glacier at the cirque front, even dashing a little upward on the opposite mountain side; and then, rushing down the steep glacial cascade where it cut off séracs and clogged crévasses, it divided on the convex surface of the lower glacier and overran both lateral moraines but failed to reach the mid-extremity of the tongue on the floor of the Allée blanche. The total distance traversed by the slide was about 8 kilometers according to the map, but only 5 according to the text; the total descent was from altitude 4,300 to 1,500 meters. The time of descent of the first slide on Nov. 14, as estimated by eye witnesses, was between 2 and 3 minutes; the velocity of movement was the greater because winter snows had not yet fallen on the ice in the great cirque. The volume of the slide was roughly estimated at between 4,000,000 and 5,000,000 cubic meters. Dust of rock and ice was spread by the wind blast of the slide, right and left of its course on the glacier and the mountain flanks, for a width of a kilometer or more; trees were overturned by the blast outside of the lower lateral moraines; a temporary lakelet was formed where the right lower branch of the slide, crossing the trough floor and ascending a little on the farther side, obstructed the Dora Baltea. The slide was evidently one of those spasmodic efforts by which the Alpine mountain faces, over-steepened by glacial sapping, try from time to time to regain more moderate slopes, such as they had in Preglacial time; but the volume of the fallen rock was but a trifling fraction of the spur from which it was detached.

W. M. D.

EXTRA-MUNDANE LIFE: A COMMENT

To the Editor of Science: In discussing the highly speculative subject of intelligent life in other worlds it is well to keep in mind two serviceable precepts of scientific reasoning: First, failure to prove that A is B is not a proof that A is not B. Thus, failure to furnish evidence that other worlds are inhabited by intelligent creatures is not to be construed as proof that such extramundane life does not exist. Second, of two discordant propositions: A is B; A is C; one of which must be true and for neither of which any evidence is forthcoming, we are intellectually bound to accord hospitality—not adoption but hospitality—to the one which is marked by the greater likelihood. Viewed without anthropometric bias this earth is, as we know, one of the less important members of the system to which it primarily belongs—a system dominated by a single undersized yellow star. If we had a time word corresponding to the space word *parsec*, and also had more definite geological knowledge of the past and future duration of this planet, we might express quantitatively the fact that the human race is relatively a mere episode in the history of the planet itself; while our increasing knowledge of the Milky Way with its encircled disk of stars must convince us that our solar system is, in turn, only an incident in the history of the stellar system to which it belongs. Which is more probable, that this one insignificant planet is the only world in which creatures capable of feeling and knowing have originated and developed, or that multitudes of other worlds have afforded both conditions and cause for life, including intelligent life, and are the homes of beings of both physical and mental parts. The latter supposition seems to be invested with incomparably greater likelihood.

Ellen Hayes

Wellesley, Mass.,
May 22

SCIENTIFIC BOOKS

The Health of the Industrial Worker. By Edgar L. Collis and Major Greenwood, containing a chapter on Reclamation of the Disabled by Arthur J. Collis and an introduction by Sir George Newman. London, J. & A. Churchill, 1921.

The appearance of the first English book on industrial hygiene could not have been more happily timed. With a combination of an industrial depression and a glutted labor market there is a widespread tendency among American managers to scrap the elaborate personnel machinery established during the war—"to safeguard the health and capacity of the

workmen . . . by sensible observance of the facts and teachings of physiological science."

The authors form a peculiarly authoritative combination. As late H. M. Medical Inspector of Factories, member of the Health of Munition Workers Committee and Director of Welfare and Health under the Ministry of Munitions, Dr. E. L. Collis brings to his task an unusual background of practical experience in preventive medicine and industry. Dr. Major Greenwood is probably the foremost British medical statistician. Both authors are members of the Industrial Fatigue Research Board.

The book is divided into four parts. In the first section an historical review of British industrial conditions preceding the eighteenth century is followed by an account of industrial legislation from the famous Ordinance of Laborers in 1349, following the Black Death, to the recent (1911) Coal Miners Act and Workmen's Compensation (Silicosis) Act of 1918. The first section closes with two valuable chapters on the utilization of statistical methods in industrial preventive medicine and the effects of industrial employment upon health as indicated by vital statistics. A study of the mortality and accident rates in the English coalfields has brought out a most suggestive correlation between the percentage of miners who voted in favor of a general strike in August, 1920, and the regional mortality distribution. In Nottinghamshire where deaths and accidents are at a minimum, only 55 per cent. of the miners favored a general strike while in Lancashire where conditions are the worst of any English coalfield, unrest was likewise at a maximum since 89.7 per cent. of the miners voted to strike. These figures indicate a deep-lying relation betwen social unrest and health conditions.

In the second part of the book a chapter is devoted to each of the following subjects: Fatigue, tuberculosis, cancer, accidents and the industrial employment of women.

> No matter in the whole field of industrial hygiene is of more fundamental importance than the occurrence of fatigue. Researches . . . into the way in which the human machine works, are showing that optimum output is obtained by not allowing fatigue to exceed physiological limits: that the goal of the economist—output—can be best attained through the same agencies as allow the medical man to obtain his objective—health.

The authors place little faith in the so-called direct tests for fatigue and caution against conclusions regarding fatigue that have been drawn from output, sickness and turnover figures, except in cases where working conditions are remarkably uniform.

The problem of industrial tuberculosis is summed up as follows:

> Not through any special intensive measures of campaigning against the tubercle bacillus, not even by the segregation of the actively tuberculous, does there seem any real hope of salvation. We have to improve the homes of the working classes in the first place—it is a sound popular instinct that inspires the popular outcry against urban and even rural housing conditions: in the second place, we have to ensure better factory conditions. We require regulations of the hours and intensity of work, of the physical characters of the atmosphere, and of the quantity and quality of the meals taken, so that the workman returning home shall not reach it in a condition of definitely lowered resistance to an infection which must still be regarded as ubiquitous.

Pathological fatigue, inadequate ventilation and insufficient food are believed to be the three outstanding disposing factors to tuberculosis among industrial workers.

Although tuberculosis has been steadily decreasing, "the sudden change which has taken place in the conditions of life consequent upon the development of modern industry, has been associated with a rapid rise in cancer mortality, and this rise is greatest where modern industry is most developed." In a selected group of occupations (1900–02) the mortality from cancer in England and Wales was greatest among chimney sweeps and seamen and least among farmers and grocers. Chimney sweeps' cancer seems to be directly associated with their occupation; in Belgium, where coal like English coal is used, there is almost complete immunity, but great care is taken to prevent contact with soot. No explanation is offered for the increasing cancer

mortality which parallels advancing industrialism.

A study of British industrial accident statistics for 1913 has shown that more fatalities resulted from persons falling than from machinery moved by mechanical power. This fact suggests a high proportion of preventable accidents and further studies have indeed shown that 60 to 80 per cent. of all industrial accidents are apparently due to mistakes on the part of the workers. Safeguarding of machinery alone has not been found to reduce accidents more than 10 per cent.—a result which conforms with American experience. The interesting studies of Greenwood and Woods regarding predisposition to accidents are presented in considerable detail and additional evidence is advanced corroborating their conclusion that a trivial accident indicates a susceptible worker.

A worker who has had three trivial accidents is a more dangerous person than one who has had a single bad wound.

In the chapter on the industrial employment of women the authors have presented a thoughtful analysis of the physical, physiological and psychological aptitudes and shortcomings of women. The commonly accepted physical inferiority of women they believe may be due to lack of physical training rather than actual structural capacity. The problem of the expectant mother was successfully met by the Ministry of Munitions by establishing a light employment dêpot.

Overalls and gloves were made and mended and other sewing work was done by expectant mothers drawn from several factories in a district. The hours of work were shorter than normal, and the workers were paid on a time basis. Milk was given in the morning, a good meal mid-day, tea in the afternoon, and a rest room provided.—The women readily availed themselves of these facilities; lost time was negligible, and work was so well done that the dêpot was a financial success.

Although the authors admit "that the effect of plumbism in causing miscarriage and still births is a sufficient reason for excluding females from exposure to lead fumes . . ." they "are unaware of any scientific evidence in support of the alleged sexual proclivity." This conclusion is contrary to the findings of Oliver, Legge and Goodby.

The third part of the book consists of a practical discussion of industrial food requirements, ventilation, lighting and general sanitary accommodations. Attention is again directed to the disproportionately high percentage of wages required for the purchase of adequate food in the case of workers on "heavy jobs," jobs that require 3,800 calories as compared with 2,800 calories for light work. According to the calculations of Greenwood, Hodson and Tebb workers in the former class must spend nearly 13 s. weekly for food alone while in the latter case 10 s. will suffice. The practical problem is complicated by the fact that remuneration is less in the case of heavy jobs than for operations needing many fewer calories. In calculating working men's budgets the physiological demands of specific occupations must therefore be taken into consideration.

The value of the chapter on ventilation might have been considerably enhanced by a discussion of some of the methods for dust determination and the presentation of E. V. Hill's "zone of comfort" chart. The report of the New York Ventilation Commission should certainly be included in the bibliography. On page 327, Fig. 26-B presents a somewhat unfortunate example of "good lighting." The intense local illumination and the consequent deep shadows and contrasts are certainly not in keeping with the best modern practise. American experience has shown that a high general illumination with local illumination reduced to a minimum gives the most satisfactory results.

The fourth section of the book will be of particular interest to industrial physicians and nurses, personnel managers and social service workers. In the opinion of the reviewer a discussion of the physical standardization of jobs, for example by Martin's method, would have been a welcome addition to the chapter on "Supervision of Industrial Health." There is far too great a tendency to depend upon such qualifications as "short

and wiry" or "tall and flabby" (p. 381) in placing prospective workers. What we have to know is the limits of physical strength required for specific jobs. Similarly the question of heart efficiency as studied by Lowsley, Crampton and Schneider in this country would be of interest to the industrial physician. The omission of the nine figures illustrating the application of iodine and finger bandages (pp. 397–400) would provide ample space for such a discussion.

The maintenance of high production in any field of activity depends upon the health of the workers. Industrial hygiene need therefore make no appeal to the charity or humanity of industrial managers. It is primarily good business. Efficient, healthy, productive men and women have a social value whether their production is for service or for profits. Under any system of social organization industrial hygiene must therefore play a leading rôle in the future development of the world's industry.

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SPECIAL ARTICLES

SOIL ACIDITY THE RESULTANT OF CHEMICAL PHENOMENA

SALTS of strong acids with strong bases, of strong acids with weak bases, of weak acids with strong bases, of weak acids with weak bases, calcium hydroxide, the lowering of the freezing point, the catalysis of esters and the hydrogen electrode are all in use in one or another of the various methods advocated for the determination of "soil acidity." The results obtained by the different methods show that the condition of a soil at any time can be considered as its progress towards a constantly changing equilibrium according to the principles of Le Chatelier. It is to be remembered that those metallic elements occurring in ordinary soil stand at the top of the electromotive series of elements and that sodium and potassium compounds are all somewhat soluble; whereas, many calcium and magnesium compounds and most iron and aluminum compounds are very sparingly soluble in water.

The entirely different results obtained with different salts, and the large variations in soil acidity recently found by Conner when soils were kept at different moisture contents, make it certain that acid soils usually contain many soluble hydrolytic products which are controlled in amount by the quantity of alkaline earths and alkali metals present in the soil.

Carbon dioxide gas has long been known to cause many chemical changes in silicates and phosphates resulting in the increased solubilities of constituents making up these substances. The following results were obtained in recent investigations where soils in culture pots were treated with carbon dioxide. (The details of the different experiments will be published elsewhere.)

1. An "alkaline" sandy soil became acid in reaction in three months treatment with carbon dioxide gas.

2. The acidity of an acid brown silt loam was increased by treating the soil with carbon dioxide gas.

3. Liming this loam decreased its acidity but not as much as the original "lime requirement" determination (Veitch) indicated. One and one half times the total lime requirement did not neutralize the soil.

4. Where the soil was limed, limed and phosphated, and limed and treated with dried blood or sodium nitrate, carbon dioxide gas additions to the soil increased the soil acidity.

5. The specific conductivity of extracts obtained on treating the soils with conductivity water showed that the carbon dioxide gas had changed the constitution of the soil. The specific conductivity of the carbon dioxide treated soils was greater.

6. The acidity of the soils was lowered by extraction with conductivity water and the lowering was greater for those samples which had been subjected to the carbon dioxide treatments. A further evidence that the acidity was due to chemical changes in the soil was that the aluminum and iron in the normal potassium nitrate extracts was effected by the carbon dioxide treatments.

7. The volatile material determination was increased by carbon dioxide treatments, and since this increase could not be accounted for in the determination of total carbon, the carbon dioxide gas must have changed the water of constitution of some of the soil silicates.

8. The composition of the conductivity water extracts from the different soils varied as the fertilizer constituents added would theoretically replace substances known to be present in the soil.

9. The composition of the conductivity extracts from the carbon dioxide treated samples showed that the increased specific conductivity and acidities due to carbon dioxide treatment were associated with substances with low solubility and ionization constants present under conditions where hydrolysis readily took place.

The shifting of the acidity, the chemical changes in the soil and the soil extracts were in accordance with the solubilities of salts of metals high in the electromotive series and their tendencies to hydrolyze. The work leads to the conclusion that soil acidity is the resultant of hydrolytic mass action phenomena and thus the application of the exact amount of lime shown by any method can not be expected to give exact neutrality.

H. A. Noyes

Mellon Institute of Industrial Research,
University of Pittsburgh,
Pittsburgh, Pa.

THE AMERICAN MATHEMATICAL SOCIETY

The two hundred and sixteenth regular meeting of the American Mathematical Society was held at Columbia University, on Saturday, April 23, 1921, extending through the usual morning and afternoon sessions. The attendance included sixty-seven members. Twenty-four new members were elected, and eleven applications for membership in the society were received.

The council voted to accept the invitation received at the February meeeting to hold the next annual meeting of the society at Toronto in connection with the meetings of the American Association for the Advancement of Science.

The following papers were read at this meeting:

On the gyroscope: W. F. Osgood.

Seven points in space and the eighth associated point: H. S. White.

Most general composition of polynomials: L. E. Dickson.

Number of real roots by Descartes' rule of signs: L. E. Dickson.

The Einstein solar field: L. P. Eisenhart.

A special kind of ruled surface: J. K. Whittemore.

On the theorems of Green and Gauss: V. C. Poor.

Pressure distribution around a breech-block: J. E. Rowe.

The mathematical theory of proportional representation. Third paper: E. V. Huntington.

On the apportionment of representatives. Second paper: F. W. Owens.

On the geometry of motion in a curved space of n dimensions: Joseph Lipka.

Note on an irregular expansion problem: Dunham Jackson.

Hyperspherical goniometry, with applications to the theory of correlation for n variables: James McMahon.

On the location of the roots of polynomials: J. L. Walsh.

The kernel of the Stieltjes integral corresponding to a completely continuous transformation: C. A. Fischer.

On a simple class of deductive systems: E. L. Post.

Topics in the theory of divergent series: W. A. Hurwitz.

A new vector method in integral equations: Norbert Wiener and F. L. Hitchcock.

On a certain type of system of ∞^2 curves: Jesse Douglas.

Concerning Laguerre's inversion: Jesse Douglas.

Closed connected point sets which are disconnected by the omission of a finite number of points: J. R. Kline.

The sum of a series as the solution of a differential equation: I. J. Schwatt.

Method for the summation of a general case of a deranged series: I. J. Schwatt.

Higher derivatives of functions of functions: I. J. Schwatt.

A covariant of three circles: A. B. Coble.

R. G. D. Richardson,
Secretary